APPENDIX B

RECLAMATION GUIDELINES

Cave Gulch-Bullfrog-Waltman Natural Gas Field Development Project

Prepared by

Oliver John Grah
ECOTONE Environmental Consulting, Inc.
P.O. Box 3516
Logan, Utah 84323-3516

TABLE OF CONTENTS

LIST OF TABLES

TABLE OF CONTENTS, Continued

Page

LIST OF TABLES, Continued

LIST OF EXHIBITS

APPENDIX B

RECLAMATION GUIDELINES

1.0 INTRODUCTION

The following erosion control, revegetation, and management guidelines are designed to attain successful reclamation of disturbed areas associated with the Cave Gulch-Bullfrog-Waltman Natural Gas Field Development Project. These recommended measures are designed to establish the feasibility of successfully reclaiming disturbances associated with this project. These guidelines were developed based on 1) Bureau of Land Management (BLM) Wyoming State Office reclamation policy (USDI-BLM 1990), 2) management directives presented in the Platte River Resource Area Resource Management Plan (RMP) (USDI-BLM 1984), 3) Executive Order 11987, 4) impacts identified in the Environmental Consequences chapter (Chapter 4) of this environmental impact statement (EIS), and 5) through issues identified during the scoping process. In addition to Chapter 4 of this EIS, environmental characterization and details that relate to reclamation feasibility are presented in the Soils, Water, and Vegetation Resources Technical Report (ECOTONE 1997). These guidelines were prepared by ECOTONE Environmental Consulting, Inc. of Logan, Utah specifically for the conditions of the project area and the objectives identified in Section 2.0 - Objectives.

The extent of possible disturbed areas to be reclaimed include the drill sites, access roads and pipelines, facilities sites, and staging areas. The following guidelines apply to the Proposed Action, Alternative A,Alternative B, and Alternative C, the "No Action" alternative. The measures presented in this appendix are designed to allow the project to be constructed without significant impacts to natural resources including soils, watershed, vegetation, and wildlife habitat. Because of the large geographic area covered by the project, 25,093 acres, and the fact that specific project facilities sites cannot be located at this time, these measures are presented in a general, non-project facility specific manner. Final selection of the measures to be applied at any given location, and modifications of these measures, will be identified by the BLM in coordination with the project operators (Operators) during the process of reviewing each Application for Permit to Drill (APD).

This appendix provides reclamation guidelines only; and therefore, this document is ***not*** a reclamation plan.The guidelines cannot be required by the BLM on state surface over state or private minerals, or on private surface over private or state minerals. The land manager and/or the land owner of State and private lands will determine the reclamation measures to be applied on those lands. The land manager and/or the land owner should find these guidelines to be appropriate for such lands.

On BLM administered lands, the final reclamation measures that would be applied should be based upon site-specific conditions and validation of these measures upon the approval of, and in agreement with, the BLM Authorized Officer (AO) during the APD review process. These guidelines describe how drilling activities should be managed to assure compliance with the resource management goals and objectives for the general area, applicable lease and unit area stipulations, and resource limitations identified during interdisciiplinary (ID) team analysis. ***If deemed necessary in light of new facts (e.g., effectiveness of specific measures, cost feasibility, and/or availability of materials and supplies, etc.) or to minimize impacts, the following measures may be applied where and when needed, added to, modified, or selectively withheld by the Operators in agreement and consultation with the BLM AO.*** Initial monitoring

for compliance and successful implementation of the mitigation measures will be under the direction of the operator. Final approval and release will be under the direction of the BLM AO on public lands.

Reclamation measures covered in this appendix fall into two general categories: temporary and final reclamation. Temporary reclamation refers to measures applied to stabilize disturbed areas and to control runoff and erosion during time periods when application of final reclamation measures is not feasible or practicable. Final reclamation refers to measures that should be applied concurrently with completion of drilling and pipeline installation, and final well site and facility abandonment.

Reclamation potential may be limited by salinity, alkalinity, steep slopes, shallow soils, shallow depth to bedrock, low precipitation, stoniness, non-cohesive soils, high wind and water erosion, periodic flooding, short growing season, seasonably high water tables, and strong winds. Intensive land-use practices may be necessary to mitigate salt and sediment loading caused by surface-disturbing activities. Activity plans (e.g., applications for permit to drill (APDs)) should address site-specific problems, including monitoring for salt and sediment loading.

In general, temporary reclamation measures should be applied to all areas not promptly reclaimed to final conditions within a specified time period whether due to adverse weather conditions, inability to secure needed materials, and/or seasonal constraints, etc. Temporary reclamation measures should be applied only as needed; as in most cases, final reclamation measures should be applied concurrently as sections of the project are completed. Temporary reclamation measures may be applied more rigorously to sensitive areas such as drainage channel crossings, steep slopes, and areas prone to high wind and water erosion. Temporary reclamation measures should include regrading the disturbed area to near predisturbance contour, respreading salvaged topsoil, mulching, and placing runoff and erosion control structures.

Final reclamation measures, in general, involve regrading the disturbed area to near predisturbance contour, respreading salvaged topsoil, applying soil amendments and protective materials (e.g., straw mulch, fertilizers, etc), if necessary, applying a prescribed seed mixture, and placing runoff and erosion control structures such as water bars and silt fences. The duration of the resultant impacts to the various vegetation community types depends in part on the success of implementation of the reclamation measures prescribed in this appendix and the time required for natural succession to return disturbed areas to predisturbance conditions after project completion.

Because wetlands are "waters of the U.S." and are therefore protected under the federal Clean Water Act (CWA), discharge of dredge or fill material into, and/or excavation of wetlands could require administrative coordination with the U.S. Army Corps of Engineers (COE) pursuant to the CWA and may require a Section 404 permit. The COE, based on the exact nature of the disturbance activity should determine the type of permit (Individual, Regional, or Nationwide) required according to the rules and regulations presented in the Federal Register (1986). Avoidance of waters of the U.S. and wetlands should be the highest priority in the planning process. A suitable wetland mitigation plan should be developed in coordination with the COE and the FWS based on these guidelines for the areas of wetlands directly impacted due to project activities where avoidance is not practicable. Impact minimization should include reducing the area of disturbance in wetland areas as well as utilizing procedures specified by authorizing agencies to cross intermittent and ephemeral drainage channels and wetland areas.

Although most intermittent and ephemeral drainage channels are not considered wetlands, the same requirements apply to the discharge of dredge and fill into these surface waters as for discharge into wetlands (see ECOTONE 1997). Residual wetland impacts that could occur after maximum avoidance and/or impact minimization has been demonstrated should be mitigated according to the following order of priority: 1) avoidance; 2) impact minimization; 3) mitigation in-kind, on-site; 4) mitigation in-kind, off-site; 5) mitigation out-of-kind, on-site; and 6) mitigation out-of-kind, off-site. In addition, the following modes of mitigation could be implemented for wetland mitigation if avoidance and impact minimization were not feasible: 1) wetlands restoration; 2) wetlands creation; and 3) wetlands enhancement. The wetlands mitigation plan should be designed to replace the area of impact and functional values associated with the disturbed area.

2.0 OBJECTIVES

This appendix is designed to meet the following objectives for reclamation of access road/pipeline ROWs and drill sites:

Short-Term (Temporary) Reclamation:

- Immediately stabilize the disturbed areas by mulching (if needed), providing runoff and erosion control, and through the initiation of new vegetation (required for problem areas; may be optional for other areas depending on consultation with the BLM).
- Control and minimize surface runoff, erosion, and sedimentation through the use of diversion and water treatment structures.
- Facilitate the re-establishment of desired native plant communities.

Long-Term (Final) Reclamation:

- Immediately stabilize the disturbed soil surface by mulching (if needed and as directed by the BLM), runoff and erosion control, and through the initiation of protective vegetation. Adequate surface roughness should exist to reduce runoff and to capture rainfall and snow melt.
- Control and minimize surface runoff, erosion, and sedimentation through the use of diversion and water treatment structures.
- Restore primary productivity of the site and establish vegetation that will provide for natural plant and community succession.
- Re-establish desired native plant communities.
- Establish a vigorous stand of desirable native plant species that will limit or preclude invasion of undesirable species, including noxious weeds.
- Revegetate the disturbed areas with plant species useful to wildlife and livestock.

- Enhance aesthetic values of disturbed areas to blend with surrounding undisturbed areas. In the long-term, reclaimed landscapes should have characteristics that approximate the visual quality of adjacent areas, including location, scale, shape, color, and orientation of major landscape features.

3.0 PERFORMANCE STANDARDS

The following performance standards should be used to determine the attainment of successful revegetation. Performance monitoring should follow the guidelines presented in the attachment to this appendix.

All Years:

- Protective cover - with the exception of active work areas, all disturbed highly erosive or sensitive areas to be left bare, unprotected, or unreclaimed for more than one month will have a protective cover of suitable material in the form of mulch, matting, or vegetative growth. All other disturbed areas should have an effective protective cover within six months.

Third Year (Final Reclamation):

- Seedling density - the density and abundance of desirable species is at least three to four seedlings per linear foot of drill row (if drilled) or transect (if broadcast) for most areas. In some sparsely vegetated areas such as badlands and sodic and saline/alkaline bottomlands, this standard can be reduced to one to two seedlings per foot to be commensurate with the naturally low vegetal cover, unless significant surface erosion is anticipated. Vegetative transects will be established on a permanent basis so that transects can be measured annually through the five year monitoring period.

- Percent cover - total vegetal cover will be at least 50 percent of predisturbance vegetal cover as measured along the reference transect for establishing baseline conditions.

By the Fifth Year (Final Reclamation):

- Percent cover - total vegetal cover will be at least 80 percent of predisturbance vegetal cover as measured along the reference transect for establishing baseline conditions.

- Dominant species - 90 percent of the revegetation consists of species included in the seed mix and/or occurs in the surrounding natural vegetation, or as deemed desirable by the BLM as measured along the reference transect for establishing baseline conditions.

- Erosion condition/soil surface factor - erosion condition of the reclaimed areas is equal to or in better condition than that measured for the reference transect for establishing baseline conditions.

4.0 METHODS

4.1 Drill Site, Access Road, and Pipeline Clearing and Topsoil Removal and Storage

In general, topsoil should be handled separately from subsoil materials. At all construction sites, topsoil should be stripped and salvaged to provide for sufficient quantities to be respread to a depth of at least four to six inches (or more if readily available on-site) over the disturbed areas to be reclaimed. In areas where deep soils exist (such as floodplains and drainage channel terraces), at least 12 inches of topsoil should be salvaged. Where soils are shallow to bedrock or have a stony subsoil, topsoil should be salvaged as specified by the AO. Topsoil should be stockpiled separately from subsoil materials. Topsoil salvaged from drill sites and stored for more than one year (under unusual circumstances) should be transported to a specified location at the margin of these sites, graded to a depth not greater than 24 inches to maintain topsoil viability, seeded with a prescribed seed mixture, and covered with mulch for protection from wind and water erosion and to discourage the invasion of weeds. Topsoil should be stockpiled separately from other earth materials to preclude contamination or mixing and should be marked with signs and identified on Construction and Design plans. Runoff should be diverted around topsoil stockpiles to minimize erosion of topsoil materials. In most cases, disturbances will be reclaimed within one year. Therefore, it is unlikely that topsoil stockpiling for more than one year will be required. Salvaged topsoil from roads and drill sites will be respread over cut-and-fill surfaces not actively used during the production phase. Upon final reclamation at the end of the project life, topsoil spread on these surfaces will be used for the overall reclamation effort.

Operators are finding out that it is not always necessary to remove all vegetation and strip all topsoil within a pipeline ROW except over the area of the trench where soil and subsoil has been excavated. Topsoil up to 12 inches deep should be removed, salvaged, and respread over the excavated trench area. In many areas, such as with deep soils on relatively flat smooth slopes with low gradients, it is possible to crush in-place rather than clear vegetation and leave topsoil in-place rather than blade and stockpile. This technique would reduce the magnitude and severity of disturbance impacts and hasten successful reclamation.

In federal jurisdictional wetland areas, vegetation should be cut off only to the ground level, leaving existing root systems intact. Cut vegetation should be removed from wetland areas for disposal. Grading activities should be limited to directly over pipeline trenches and access roads. At least 12 inches of topsoil should be salvaged and replaced except in areas with standing water or saturated soils. Use of construction equipment in wetland areas should be limited. Dirt, rockfill, or brush riprap should not be used to stabilize pipeline ROWs. If standing water or saturated soils are present, wide-track or balloon-tire construction equipment should be used or normal construction equipment should be operated on equipment pads or geotextile fabric overlain with gravel fill. Equipment pads etc., should be removed immediately upon completion of construction activities. Trench spoil should be placed at least 10 feet away from drainage channel banks for all minor and major drainage channel crossings.

4.2 Drill Site, Access Road, and Pipeline Construction

4.2.1 Upland Areas

Uplands include all areas away from wetlands and alluvial bottomlands or other areas that have excess soil moisture for prolonged periods or have shallow water tables. Construction should be accomplished following site-specific Construction and Design plans and applicable agency specifications. At drill sites, and along the areas of access roads or pipelines traversing steep slopes, slope angles should be minimized to enhance retention of topsoil, and reduce erosion as well as facilitate revegetation, and subsequent reclamation success. Slope stabilizing revetment structures may be necessary in areas where the substrata materials are unconsolidated and loose and cannot be stabilized with revegetation and mulch.

Surface runoff should be controlled at all well sites through the use of interception ditches and berms. A berm approximately 18 inches high should be constructed around fill portions of these well sites to control and contain all surface runoff generated or fuel or petroleum product spills on the pad surface. Water contained on the drill pads should be treated in a detention pond prior to discharge into undisturbed areas in the same manner as discussed previously. This system should also serve to capture fuel and chemical spills, should they occur.

Erosion and sedimentation control measures and structures, as approved by the AO, should be installed on all disturbed areas. Soil erosion control should be accomplished on sites in highly erosive soils and steep areas, as needed, with mulching, netting, tackifiers, hydromulch, matting, and excelsior. The type of control measure should depend on slope gradients and the susceptibility of soil to wind and water erosion. Silt fences should be placed at the base of all steep fill slopes and sensitive disturbed areas. All runoff and erosion control structures should be inspected periodically, cleaned out, and maintained in functional condition throughout the duration of construction and drilling. Water bars should be constructed on cut-and-fill slopes exceeding 25 feet long and 10 percent gradient using the water bar spacing guidelines and procedures specified for access road and pipeline ROW runoff and erosion control.

Runoff and erosion control along access road/pipeline ROWs should be accomplished by implementing standard cross drain, culvert, road ditch, and turnout design as well as timely mulching and revegetation of exposed cut, fill, and road shoulders. All culverts should be constructed with riprapped entrances and exits and with energy dissipators or other scour- reducing techniques as needed and where appropriate. Water discharged from culverts, cross drains, road ditches and turnouts should be directed into undisturbed vegetation away from all natural drainages. Erosion and sedimentation control measures and structures, as approved by the AO, should be installed across all cut-and-fill slopes within 100 feet of drainage channels. All runoff and erosion control structures should be inspected after major runoff events and at a regular schedule. If found to be sub-standard, these structures should be cleaned out and maintained in functional condition throughout the life of the project.

4.2.2 Drainage Channel Crossings

Construction of all drainage channel crossings should minimize the disturbance to drainage channels and wetlands to the extent practicable and should occur during the low runoff period (June 15 through March 1), or as directed by the AO. Staging areas, if used for a given crossing,

should be limited in size to the minimum necessary and should be located at least 50 feet from drainage channel bottoms (or greater if in wetlands), where topographic conditions permit. Drainage channel crossings should be constructed as perpendicular to the axis of the drainage channel and at the narrowest positions as engineering and routing conditions permit. Clean gravel should be used for the upper one foot of fill over the backfilled pipeline trenches in perennial and intermittent streams. Silt fences or other sediment filtering devices such as weed-free straw bales should be installed at drainage channel banks where sedimentation is excessive and at the base of all slopes adjacent to wetlands.

Trench plugs should be employed during pipeline construction at non-flumed drainage crossings to prevent diversion of drainage channel flows into upland portions of pipeline trenches during construction. Application of riprap should be limited to areas where flow conditions prevent vegetative stabilization; riprap activities must comply with COE permit requirements. Pipeline trenches should be dewatered in such a manner that no silt laden water flows into active drainage channels (i.e., prior to discharge the water will be filtered through a silt fence, weed-free straw bales, or allowed to settle in a sediment detention pond).

After the completion of construction, all areas where soil has been disturbed that are not part of the actual road should be revegetated according to the revegetation specifications subsequently described. Where vegetation is disturbed, temporary sediment barriers such as silt fences and/or staked weed-free straw bales should be installed along the topographic contour at the base of the slope adjacent to the road crossing. Temporary sediment barriers should remain in-place until permanent revegetation measures have been judged successful by the AO.

4.2.3 Wetlands and Alluvial Bottomlands

Access roads and pipelines should be rerouted, and drill sites located, to avoid these areas to the maximum extent practicable. RMP management directives require a set back of 500 feet of live streams, lakes, reservoirs, and canals and associated riparian habitat; 500 feet of water wells; 660 feet of springs or artesian and flowing wells; and 200 feet of intermittent and ephemeral streams. The size of staging areas should be limited to the minimum necessary and all staging areas should be located out of these areas unless such avoidance is not practicable. Where avoidance is not practicable, staging areas should be located at least 50 feet from the edge of wetland areas, where topographic conditions permit. The width of the access road and pipeline construction ROW should be limited to no more than 50 feet. Hazardous materials should not be stored and equipment should not be refueled within 100 feet of wetland boundaries. Appropriate permits should be secured from the COE prior to any construction activities in federal jurisdictional wetland areas.

4.3 Surface Runoff and Erosion Control

4.3.1 Drill Site, Access Road, and Pipeline Right-of-Way

4.3.1.1 Temporary Reclamation

Temporary erosion control measures, where needed, may include application of mulch and netting of biodegradable erosion control blankets stapled firmly to the soil surface, respreading scalped vegetation, construction of water bars, application of soil stabilizers or tackifiers, use of a standing

crop of an annual grain (e.g., sterile barley), or other procedures as directed by the AO. See Final Reclamation measures for specific information pertaining to mulching.

The actual distance of a pipeline/road ROW requiring stabilization on each side of a drainage channel should be determined on a site-specific basis as directed by the AO. To minimize sedimentation of drainage channels and wetlands during the interim period between construction activity and final reclamation, temporary erosion and sediment control measures should be applied. Silt fences or other sediment filtering devices such as weed-free straw bales should be installed at drainage channel banks where sedimentation is excessive and at the base of all slopes adjacent to wetlands. These structures should be keyed into the soil to prevent surface water from going under or around the structure. This includes excavating a shallow trench and burying the bottom of the structures. Where straw bales are used, they should be reinforced by pounding re-bar through the bales and into the soil. Exhibit B-1 presents schematics of water bar and silt fence construction. Sediment filtering devices should be cleaned out and maintained in functional condition throughout the life of the project. To avoid the possibility of mulching materials entering waterways, loose mulch (i.e., mulch not crimped into the soil surface, tackified, or incorporated into erosion control blankets) should not be applied to drainage channel banks.

If construction is completed prior to the specified seeding season for perennial vegetation, areas adjacent to the larger drainage channels should be covered with jute matting for a minimum of 50 feet on either side of the drainage channel. In addition, to protect soil from raindrop impact and subsequent erosion, 2.0 tons/acre of a weed-free straw mulch should be applied to all slopes greater than 10 percent. Temporary erosion control measures may include leaving the ROW in a roughened condition, respreading scalped vegetation, or applying mulch as specified by the AO.

As indicated by several operators and the BLM, weed-free straw mulch is difficult to obtain in quantities and at costs suitable for all reclamation applications. Although this circumstance could reduce the application of the measure, the effectiveness of mulch in protecting the exposed soil from raindrop impact, erosion, and off-site sedimentation should not be ignored. As discussed in the Soils, Water, and Vegetation Resources Technical Report (ECOTONE 1997), the effective application of mulch can reduce soil erosion by as much as 900 percent. In addition to its effectiveness in erosion control, mulching also benefits the soil as a plant growth medium in most cases. Therefore, effective mulching is fundamental to reducing soil erosion to acceptable, non-significant levels.

Trench breakers should be used for pipeline construction in certain areas to prevent the flow of water in either a trench that has been backfilled or temporarily left open. Trench breakers are particularly important in wetland areas to minimize subsurface drainage. Trench breakers should be constructed such that the bottom of one breaker is at the same elevation as the top of the next breaker down slope, or every 50 feet, whichever is greater. Factors that control the application of trench breakers include the proximity to drainage channels and wetland areas, slope gradient, proximity of areas to shallow groundwater, and surface runoff source areas that can discharge water into the trench. Trench breakers should be installed, where necessary, as directed by the AO. Topsoil should not be used to construct trench breakers.

If a pipeline crosses roads at the base of slopes, vegetative strips should be maintained. If vegetation is disturbed within these limits, temporary sediment barriers such as silt fences and/or staked weed-free straw bales should be installed at the base of the slope adjacent to the road

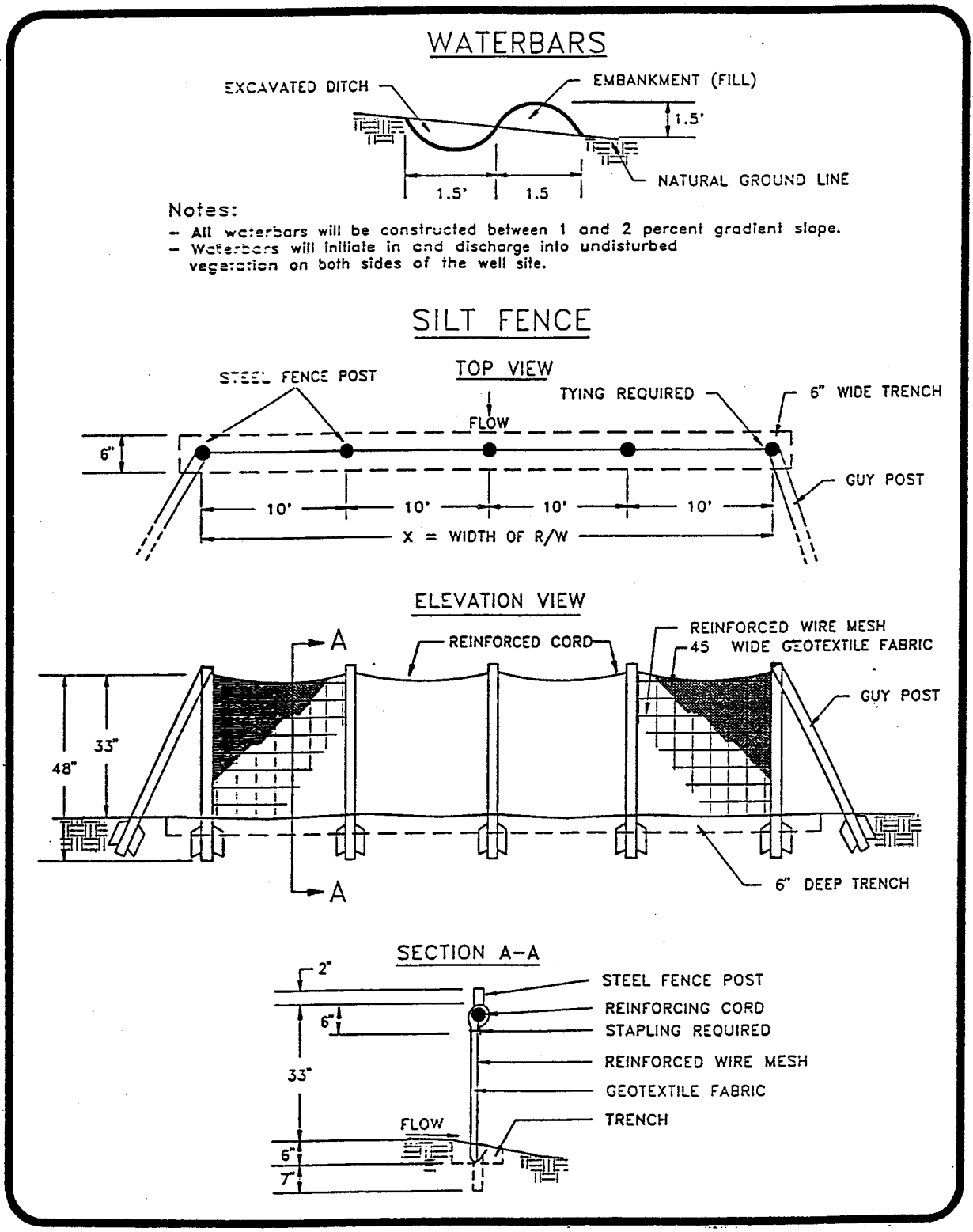

Exhibit B-1. Water Bar Construction and Silt Fence Construction.

crossing. Temporary sediment barriers should remain in-place until permanent revegetation measures have been judged successful by the AO.

4.3.1.2 Final Reclamation

4.3.1.2.1 Upland Areas

Runoff and erosion control along all ROWs should be accomplished by constructing sediment trapping devices (e.g., silt fences and straw bales) and water bars, as well as by timely mulching and revegetation of exposed disturbed areas. Runoff discharged from water bars should be directed into undisturbed vegetation away from all natural drainages. Erosion and sedimentation control measures and structures, as approved by the AO, should be installed across all cut-and-fill slopes, where needed. All runoff and erosion control structures should be inspected after major runoff events and at a regular schedule. If found to be substandard or ineffective, these structures should be cleaned out and maintained in functional condition until successful revegetation and soil stability is attained.

Water bars should be constructed across sideslopes at appropriate intervals according to slope gradient immediately following recontouring of the disturbed areas. The spacing should depend on whether mulching is applied in conjunction with placement of water bars. Water bars should be maintained in functional condition throughout the life of the project. Should the integrity of the water bar system be disrupted during seeding, water bars should be repaired and broadcast seeded with the seed raked into the soil. Water bars should be constructed according to hillslope topography at the slope gradient intervals as shown in Table B-1, or as directed by the AO or landowner.

Water bars should be constructed 12 to 18 inches deep by digging a small trench and casting the soil material to the downhill side in a row. Each water bar should initiate in undisturbed vegetation upslope or upgradient of the disturbance, traverse the disturbed area at a side hill gradient between one and two percent, and discharge water into undisturbed vegetation on the lower side of the disturbed area. ***Particular attention must be given to the construction of water bars to ensure effectiveness. Water bars are frequently constructed perpendicular to disturbances that traverse across slopes resulting in water bars that are oriented up and down slopes. This circumstance results in ineffective water bars or water bars that facilitate surface runoff and erosion rather than provide control.***

Table B-1. Water Bar Intervals According to Slope Gradient[1].

With Mulching		Without Mulching	
Slope Gradient (percent)	Interval (feet)	Slope Gradient (percent)	Interval (feet)
10	150	10	100
15	100	15	75
20	50	20	45
30	40	30	40
40	35	40	35
50	30	50	30
>50	30	>50	30

1 - Based on Grah (1989).

4.3.1.2.2 Wetlands and Drainage Channel Crossings

Disturbance to the ephemeral and intermittent drainage channels should be avoided and/or minimized. All channel crossings not maintained for access roads should be restored to near predisturbance conditions. Drainage channel bank slope gradients should be regraded to conform with adjacent slope gradients. Channel crossings should be designed to minimize changes in channel geometry and subsequent changes in flow hydraulics. Culverts should be installed for ephemeral and intermittent drainage channel crossings. All drainage channel crossing structures should be designed to carry the 25- to 50-year discharge event as directed by the BLM. Silt fences should be constructed at the base of slopes at all drainage channel crossings. Minor routing variations should be implemented during access road, pipeline, and drill site layout to avoid washes. The area of disturbance in the vicinity of washes should be minimized. Per the RMP, a 500-foot-wide buffer strip of natural vegetation should be maintained between all construction activities and drainage channels.

Trench plugs should be employed at non-flumed drainage crossings to prevent diversion of drainage channel flows into upland portions of pipeline trenches during construction. Application of riprap should be limited to areas where flow conditions prevent vegetative stabilization; riprap activities must comply with COE permit requirements. Pipeline trenches should be dewatered in such a manner that no silt laden water flows into active drainage channels (i.e., prior to discharge the water should be filtered through a silt fence, weed-free straw bales, or allowed to settle in a sediment detention pond).

4.4 Final Reclamation

4.4.1 Topsoil Respreading and Seedbed Preparation

In preparation for seeding, at least four to six inches of topsoil should be evenly respread over the pipeline ROW, staging areas, cut-and-fill surfaces, and all areas of other sites not required for production purposes.

Soil compaction could result from heavy equipment working on disturbed soils prior to revegetation. Therefore, compaction is likely to occur under most situations. Soil compaction can inhibit adequate revegetation of disturbances. Therefore, all disturbances to be revegetated will be ripped to reduce the adverse effect of compaction. A spring tooth harrow equipped with utility or seedbed teeth, or ripper-teeth equipment mounted behind a large tractor, cat, or patrol, as directed by the AO, should be used to loosen the subsoil. The subsoil surface should be left rough. After topsoil has been respread and if it is loose, it should be lightly compacted with a cultipacker or similar implement to provide a firm seedbed. On steep slopes (greater than 40 percent and highly erosive), it may be difficult or impossible to replace topsoil and adequately prepare the seedbed. All disturbed areas should be ripped on 18- to 26-inch spacing and 12 to 16 inches deep. These areas should then be mulched with a hydromulch/seed/tackifier mix. If implemented, erosion control blankets with seed incorporated into the matting should be installed per manufacturer's specifications to enhance soil stabilization.

4.4.2 Seed Application

All disturbed areas should be seeded immediately following the final grading of the topsoil to the approximate original contour, weather and season permitting as discussed below. The seedbed should be prepared to a depth of three to four inches where possible to provide a firm seedbed. If hydroseeding or broadcast seeding is employed, the seedbed should be scarified to ensure good seed-soil contact. After completion of seedbed preparation, the seed mixtures recommended in Tables B-2 through B-7, or a similar mix, as directed by the AO, should be applied according to the pure live seed (PLS) rates and drilling depths specified, to areas along the road and pipeline ROW, staging areas, and unused areas of drill sites that have been retopsoiled.

Seed should be used within 12 months of viability testing. Legume species purchased commercially must have been properly inoculated with nitrogen-fixing bacteria. Seed should be planted in the fall (after September 31) or no later than late fall (mid-November) prior to snow accumulation to avoid seed germination and breaking of dormancy and to prevent seedling frost damage; or in early Spring (prior to May 15); or as directed by the AO. Seed should not be applied when soils are frozen or excessively wet. Seed should preferably be planted with drill-type of equipment such as a rangeland drill or brillion seeder where and when possible as directed by the BLM. Where the microtopography of the disturbed areas does not allow drill-type equipment, seed should be broadcast applied at twice the application rate of drilled seed. A spike-toothed harrow or similar equipment should be used where ripping has been insufficient to provide cover for the broadcast seed. Some areas may require the planting of containerized seedlings to speed up successful reclamation particularly in areas of sensitive soils as described in Section 3.5 of the DEIS. Also, some seed is more effectively established by broadcast seeding as apposed to drill seeding such as Wyoming big sagebrush.

Any soil disturbance that occurs outside the recommended permanent seeding season, or any bare soil left unstabilized by vegetation, should be treated as a winter-construction problem and mulching should be considered, or the site stabilized and/or other actions taken as otherwise directed by the AO.

The seed mixtures presented in Tables B-2 through B-7, or similar mixtures as specified by the AO, should be applied according to specific areas identified to be homogeneous in terms of overall ecosystem similarities such as precipitation zones, elevational zones, dominant species herbaceous cover, soil types, and inherent limitations in reclamation success potential. Various vegetation cover types in the project area are described in Chapter 3 of the EIS and in the Soils, Water, and Vegetation Resources Technical Report (ECOTONE 1997).

These seed mixes were developed based on the following criteria: 1) site-specific conditions of the analysis area; 2) species/cultivar adaptation to site conditions; 3) usefulness of species in rapid site stabilization; 4) species success in revegetation efforts; 5) current seed costs and availability; and 6) compliance with Executive Order 11987. Only native species are included in these seed mixes in compliance with Executive Order 11987 and BLM reclamation policy. Certain introduced cultivars have been developed that have utility in site stabilization and revegetation. These species should only be considered if a revegetation or reclamation failure has occurred. The Operators should coordinate with the BLM AO in regard to approval of the use of introduced species in the reclamation effort. Final seed mixes applied in the revegetation effort should be designed in coordination with the BLM during the APD approval process.

Final determination of the appropriate seed mixture should be developed on a site-specific basis at the time of field review of the facility. Seeding rates may be varied to enhance the probability for maintaining the natural balance of species. Watershed protection must be emphasized when reclaiming disturbed areas. The composition of rare and native species, if encountered at a disturbed site, should be taken into consideration at the time of seeding; however, appropriate measures must be taken to ensure that an adequate protection of the soil surface is obtained.

Table B-2. Recommended Seed Mixture[1] #1 - Mixed Desert Shrub Cover Type.

Species	Cultivar or Variety	Seed Application Drilled Rate (pls[2] lbs/ac)	Planting Depth (if drilled) (inches)
Grasses			
Western wheatgrass (*Agropyron smithii*)	Rosanna	2.0	0.5
Bluebunch wheatgrass (*Agropyron spicatum*)	Secar	3.0	0.5
Great Basin Wildrye (*Elymus cinereus*)	Trailhead	2.0	0.5
Indian ricegrass (*Oryzopsis hymenoides*)	Nezpar	3.0	0.5
Needle-and-Thread (*Stipa comata*)	-	1.0	0.5
Sandberg bluegrass (*Poa sandbergii*)	-	1.0	0.5
Forbs			
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	-	1.0	0.5
White yarrow (*Achillea millefolium*)	-	1.0	0.25
Northern sweetvetch (*Hedysarum boreale*)	-	2.0	0.5
Shrubs			
Wyoming big sagebrush (*Artemisia tridentata*)	-	0.5	0.25
Rubber rabbitbrush (*Chrysothamnus nauseosus*)	-	1.0	0.25
Winterfat (*Ceratoides lanata*)	-	1.0	0.5
Shadscale (*Atriplex confertifolia*)		2.0	0.5
TOTAL		**20.5**	

1 - Seed mix based on adaptation to the site conditions of the project, usefulness of species for rapid site stabilization, species success in revegetation efforts, and current seed availability and cost.
2 - PLS = pure live seed.

Table B-3. Recommended Seed Mixture[1] #2 - Vegetated Sand Dune Vegetation Cover Type.

Species	Cultivar or Variety	Seed Application Drilled Rate (pls[2] lbs/ac)	Planting Depth (if drilled) (inches)
Grasses			
Prairie sandreed (*Calamovilfa longifolia*)	Goshen	3.0	0.5
Bluebunch wheatgrass (*Agropyron spicatum*)	Secar	2.0	0.5
Sand dropseed (*Sporobolus cryptandrus*)	-	1.0	0.25
Indian ricegrass (*Oryzopsis hymenoides*)	Nezpar	3.0	0.5
Needle-and-Thread (*Stipa comata*)	-	2.0	0.5
Forbs			
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	-	1.0	0.5
Desert Indian paintbrush (*Castilleja chromosa*)	-	1.0	0.25
Northern sweetvetch (*Hedysarum boreale*)	-	1.0	0.5
Shrubs			
Wyoming big sagebrush (*Artemisia tridentata*)	-	0.5	0.25
Rubber rabbitbrush (*Chrysothamnus nauseosus*)	-	1.0	0.25
Spiny hopsage (*Grayia spinosa*)	-	1.0	0.5
Douglas rabbitbrush (*Chrysothamnus vicidiflorus*)	-	1.0	0.5
TOTAL		**17.5**	

1 - Seed mix based on adaptation to the site conditions of the project, usefulness of species for rapid site stabilization, species success in revegetation efforts, and current seed availability and cost.
2 - PLS = pure live seed.

Table B-4. Recommended Seed Mixture[1] #3 - Alkali Scrub Cover Type.

Species	Cultivar or Variety	Seed Application Drilled Rate (pls[2] lbs/ac)	Planting Depth (if drilled) (inches)
Grasses			
Sandberg bluegrass (*Poa sandbergii*)	-	2.0	0.5
Western wheatgrass (*Agropyron smithii*)	Rosanna	2.0	0.5
Alkaligrass (*Puccinellia distans*)	Fults	3.0	0.5
Alkali sacaton (*Sporobolus airoides*)	Salado	3.0	0.5
Forbs			
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	-	1.0	0.5
Northern sweetvetch (*Hedysarum boreale*)	-	2.0	0.5
Shrubs			
Spiny hopsage (*Grayia spinosa*)	-	1.0	0.5
Winterfat (*Ceratoides lanata*)	-	1.0	0.5
Gardner saltbush (*Atriplex gardneri*)	-	1.0	0.5
Black greasewood (*Sarcobatus vermiculatus*)	-	1.0	0.5
TOTAL		**17.0**	

1 - Seed mix based on adaptation to the site conditions of the project, usefulness of species for rapid site stabilization, species success in revegetation efforts, and current seed availability and cost.
2 - PLS = pure live seed.

Table B-5. Recommended Seed Mixture[1] #4 - Badlands Cover Type.

Species	Cultivar or Variety	Seed Application Drilled Rate (pls[2] lbs/ac)	Planting Depth (if drilled) (inches)
Grasses			
Sheep fescue (*Festuca ovina*)	Covar	3.0	0.5
Bottlebrush squirreltail (*Sitanion hystrix*)	-	3.0	0.5
Alkali sacaton (*Sporobolus airoides*)	Salado	3.0	0.5
Forbs			
Gooseberryleaf globemallow (*Sphaeralcea grossulariaefolia*)	-	1.0	0.5
Northern sweetvetch (*Hedysarum boreale*)	-	2.0	0.5
Shrubs			
Spiny hopsage (*Grayia spinosa*)	-	1.0	0.5
Winterfat (*Ceratoides lanata*)	-	1.0	0.5
Gardner saltbush (*Atriplex gardneri*)	-	1.0	0.5
TOTAL		**15.0**	

1 - Seed mix based on adaptation to the site conditions of the project, usefulness of species for rapid site stabilization, species success in revegetation efforts, and current seed availability and cost.
2 - PLS = pure live seed.

Table B-6. Recommended Seed Mixture[1] #5 - Wet Meadow Cover Type.

Species	Cultivar or Variety	Seed Application Drilled Rate (pls[2] lbs/ac)	Planting Depth (if drilled) (inches)
Grasses			
Nebraska sedge (*Carex nebrascensis*)	-	2.0	0.5
Redtop (*Agrostis stolonifera*)	-	2.0	0.5
Bluejoint reedgrass (*Calamagrostis canadensis*)	Sourdough	2.0	0.25
Tufted hairgrass (*Deschampsia cespitosa*)	-	4.0	0.25
Forbs			
Northern sweetvetch (*Hedysarum boreale*)	-	2.0	0.5
Blue-leaf aster (*Aster glaucodes*)	-	1.0	0.5
Golden banner (*Thermopsis montanus*)	-	2.0	0.5
TOTAL		**15.0**	

1 - Seed mix based on adaptation to the site conditions of the project, usefulness of species for rapid site stabilization, species success in revegetation efforts, and current seed availability and cost.
2 - PLS = pure live seed.

Table B-7. Seed Mixture[1] #6 - Marsh Cover Type.

SPECIES	CULTIVAR OR VARIETY	SEED APPLICATION BROADCAST RATE (PLS[2] lbs/ac)	PLANTING DEPTH (inches)
GRASSES:			
Bluejoint reedgrass (*Calamagrostis canadensis*)	-	3.0	0.5
American sloughgrass (*Beckmannia syzigachne*)	Egan	4.0	0.25
GRAMINOIDS:			
Beaked sedge (*Carex rostrata*)	-	2.0	0.5
Alkali bulrush (*Scirpus maritima*)	-	2.0	0.5
Cattail (*Typha latifolia*)	-	0.5	0.25
TOTAL		**11.5**	

1 - Seed mix based on adaptation to the site conditions of the project, usefulness of species for rapid site stabilization, species success in revegetation efforts, current seed availability and cost, and specific project objectives.
2 - PLS = pure live seed.

Areas not exhibiting successful revegetation (as determined by the AO or Environmental Inspector) should be reseeded and/or improved with soil amendments deemed necessary by the AO until an adequate cover of vegetation is established.

State, private, and agricultural lands should be seeded according to the landowner's request. Should the landowner not specify a recommended seed mixture, the AO should determine the appropriate seed mixture to apply.

4.4.3 Mulching

In sensitive sites where significant erosion (e.g., large areas of disturbance or areas with high erosion rates) is most likely to occur, the seeded access road/pipeline ROW, staging areas, and the portion of the drill pads not needed for production purposes should be mulched following seeding to protect the soil from wind and water erosion, raindrop impact, surface runoff, and noxious weed invasion, and to hold the seed in place. The exposed surface of disturbed areas, including topsoil stockpiles, may be protected by placing crimped straw mulch, hydromulch, biodegradable plastic netting and matting, or biodegradable erosion control blankets.

All sensitive disturbed areas should be mulched immediately following seeding with 1.5 to 2.0 tons/acre of a weed-free straw mulch. Mulching materials should be reasonably free of noxious and undesirable plant species as defined by state or county lists. Hay mulch may be used, but it should be applied only if cost-competitive and if crimped into the soil. Straw mulch is more desirable than hay mulch because it is generally less palatable to feral horses, wildlife, and livestock. Additionally, there tends to be a higher risk of introducing undesirable species and noxious weeds with a hay mulch such as smooth brome, timothy, orchardgrass and other minor species. The lessee should maintain all disturbances relatively weed-free for the life of the project through implementation of a noxious weed monitoring and eradication program.

Wherever utilized, mulch should be spread uniformly so that at least 75 percent of the soil surface is covered. If a mulch blower is used, the straw strands should not be shredded less than eight inches in length to allow effective anchoring. On slopes less than 30 percent, straw mulch should be applied by a mechanical mulch blower at a rate of 2.0 tons/acre after seeding. The mulch should be crimped into the soil surface using a serrated disc crimper or similar implement as directed by the AO. Where broadcast straw mulch is applied on windswept slopes, a biodegradable plastic netting should be staked firmly to the soil surface over the mulch following the manufacturer's specifications. On slopes in excess of 40 percent or on slopes exceeding the operating capabilities of machinery, hydromulch or biodegradable erosion control blankets with seed incorporated into the netting should be applied and staked firmly to the soil surface.

Where utilized, hydromulch and tackifier should be applied at a rate of 1,500 lbs/acre or as otherwise approved by the AO. In general, erosion control and soil stabilization are directly related to the amount of mulch applied. Under certain conditions where degradation processes are slow (e.g., in extremely hot or cold dry climates), a trade-off between the degree of effectiveness of mulch and long-term degradation should be considered. In extremely dry areas where mulch degradation may be slow, mulching rates should be reduced to 1.0 to 1.5 tons/acre or as specified by the AO. Special measures may need to be implemented in areas with sandy soils.

On steeper slopes with highly erodible, shallow, rocky soils and/or on windswept areas with loose, unconsolidated materials, the above recommended measures may not be sufficient to reduce erosion to non-significant levels. The following measure should be considered by the operator and the BLM to stabilize such sites: incorporating a custom blend of seed into erosion control blankets. This method has proven cost-effective in many cases, with 98 percent of the cost being the blanket itself. The additional cost of incorporating seed into the blanket will average $1.00 to $1.50 per blanket, depending upon current seed costs. In most cases, this additional cost should offset the repeated efforts of broadcast seeding, manual raking of seeds into the soil, and mobilizing a labor force to remediate unsuccessful revegetation. The AO should determine the final measure(s) to be implemented in such areas.

4.4.4 Livestock Control

Livestock grazing should be monitored along all areas of drill sites and access road and pipeline ROW. Should grazing negatively impact revegetation success, measures should be taken to immediately remove livestock from the newly reclaimed areas. Such measures could include herding, placement of mineral blocks, provision of water sources, and fencing. It would be cost infeasible to fence linear facilities (e.g., pipelines and roads). However, drill sites could be fenced. Depending upon site-specific evaluations, it may be necessary to temporarily fence off certain riparian areas and wetlands to prevent excessive livestock grazing and trampling to enhance drainage channel bank stabilization and overall revegetation success. Existing livestock control structures such as fences and cattleguards should be maintained in functional condition during all phases of the project. Where road access requires the disruption of an existing fence, a cattleguard should be installed at the juncture.

4.4.5 Off-Road Vehicle Control

Off-road vehicle control measures should be installed and maintained as specified by the AO and landowners following the completion of seeding. Examples of measures include a deep trench; a locking, heavy steel gate with fencing extending a reasonable distance to prevent bypassing the gate, with appropriate signs posted; a slash barrier; a pipe barrier; placement of large boulders; or signs posted at all points of access at intervals not to exceed 2,000 feet indicating "This Area Seeded for Wildlife Benefits and Erosion Control." Operators should monitor the use of pipeline alignments for adverse use and if degradation or damage of the revegetation effort is identified, appropriate remediation should be applied in consultation with the BLM.

4.4.6 Fugitive Dust Control

Should fugitive dust generated during construction of the drill sites, access road/pipeline ROWs, or staging areas become a problem, dust abatement measures should be implemented. Such procedures should be determined by the AO and could include applying water or water with additives (e.g., magnesium chloride) to the construction area at regular intervals, placement of gravel on traveled surfaces, placement of mulch and/or matting, or as directed by the AO.

4.5 Monitoring and Maintenance

4.5.1 General

Successful reclamation and revegetation cannot always be assured. Performance monitoring is required to evaluate the temporal condition of the effort, determine the prognosis for success, and determine if remediation is required. A designated BLM official or responsible representative of the Operators should annually inspect and review the condition of drill sites, access road/pipeline ROWs, and any other disturbed areas associated with the project. This official and/or representative should assess the success of and prognosis for success of runoff and erosion control and revegetation efforts, evaluate fugitive dust control needs, and recommend remediation measures, if necessary. In addition, monitoring should take place following each major runoff event. Photographs should be taken at drill sites and along access roads at specific areas to document the progress of the reclamation program at established photomonitoring points. The frequency and intensity of monitoring should be coordinated with the BLM.

The following specific items should be monitored during inspections:

- revegetation success;
- sheet and rill erosion, gullies, slumping, and subsidence;
- soundness and effectiveness of erosion control measures;
- sediment filtering devices along all active ephemeral and intermittent drainage channels;
- water quality and quantity;
- noxious weed invasion;
- degree of rodent damage on seed and seedlings;
- locations of unauthorized off-highway vehicle (OHV) access;
- soundness and effectiveness of OHV control structures;
- evidence of livestock or wildlife grazing; and
- overgrazing/trampling of riparian and wetland areas.

4.5.2 Reclamation Success Monitoring

Reclamation success should be based upon the objectives specified in this appendix; therefore, monitoring should be tied to these objectives. The actual monitoring procedures for quantitative and qualitative evaluations of reclamation success should be implemented as specified by the BLM or other authorizing agencies. The attachment to this appendix presents monitoring guidelines generally accepted by the BLM.

Reclamation success should be monitored both in the short term (temporary reclamation) and in the long term (final reclamation). Monitoring of temporary reclamation measures should include visual observations of soil stability, condition, and effectiveness of mulching and runoff and erosion control measures and a quantitative and qualitative evaluation of revegetation success, where appropriate. Long-term reclamation monitoring should include visual observations of soil stability, condition of the effectiveness of mulching and runoff and erosion control measures, and a quantitative and qualitative evaluation of revegetation success.

Revegetation success should be determined through monitoring and evaluation of percent ground cover to include a measure of vegetal cover (by species), litter/mulch, rock/gravel, and bare ground. Ground cover should be documented at each 1-foot interval along a 100-foot line intercept transect. Seedling density and relative abundance should be determined by selection of plots at the 20-, 40-, 60-, and 80-foot marks on the transect. Grazing impacts should be assessed as an ocular estimate of the percent utilization along the transect.

Soil stability should be measured using an erosion condition class/soil surface factor rating method to numerically rate soil movement, surface litter, surface rock, pedestalling, flow patterns, and rill-gully formation. Information obtained through this rating system represents an expression of current erosion activity and can be used to reflect revegetation success as a function of soil stability.

The access road boundaries, pipelines, and unused portions of the drill sites should be monitored until released by the AO upon attainment of 80 percent of predisturbance vegetative cover within five years of seeding. This standard should include 90 percent of the vegetative cover being comprised of desirable species and the erosion condition of the reclaimed area being equal to or in better condition than predisturbance conditions as prescribed under the Performance Standard section of this appendix.

4.5.3 Wetland and Drainage Channel Crossings

Wetland areas and natural drainage channel crossings should be monitored for a minimum of three years for noxious weed invasion and establishment of undesirable species. Noxious weeds should not be allowed to establish at any time. If found in a reclaimed wetland or drainage channel crossing, the noxious weeds should be removed. Undesirable species should not be allowed to establish. At the third year of monitoring, undesirable species should comprise no more than 15 percent of the total vegetation cover. The lessee should maintain wetland areas and drainage channel crossings according to this standard throughout the development of a noxious weed and undesirable species monitoring and eradication program.

4.5.4 Photomonitoring

Permanent photomonitoring points should be established at appropriate vantage locations that provide adequate visual access to drill sites, along pipeline and access road rights-of-way, and to ancillary facilities. Each photomonitoring point should be permanently marked with re-bar and identified on a topographic map of the area. The location of each point should be described in detail to assist in relocation from year to year. Photos should be taken at each photomonitoring point prior to initiation of construction. Photos, framing the same scene as previously taken, should be taken each formal visit until reclamation standards have been met. These photographs should be included in the periodic reports submitted to the BLM and other interested agencies.

5.0 REFERENCES CITED

ECOTONE Environmental Consulting, Inc. (ECOTONE) 1997. Soils, Water, and Vegetation Resources Technical Report for the Cave Gulch-Bullfrog-Waltman Natural Gas Field Development Project. Technical report prepared in support of the Cave Gulch-Bullfrog-Waltman Natural Gas Field Development Project EIS.

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U.S. Bureau of Land Management (USDI-BLM). 1984a. Platte River Resource Area Resource Management Plan DRAFT Environmental Impact Statement. Vols. I and II. Bureau of Land Management, Wyoming State Office, Cheyenne, WY. BLM-WY-ES-84-008-4410. 336 pp.

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ATTACHMENT TO APPENDIX B

Recommended Reclamation Performance Monitoring Guidelines

Objectives

The general purpose of this plan is to initiate a systematic, documented approach to monitoring existing and future reclamation of surface disturbance. This includes evaluation of methods to assist in making future land management decisions. More specific objectives include the following:

1. To outline agency and company responsibilities in regard to implementation of monitoring.

2. To provide guidelines for documenting site-specific information and monitoring procedures, methods and objectives.

3. To outline methods for monitoring progress and evaluating success of reclamation efforts.

4. To increase probability of the reclamation success on future projects.

Responsibility

Federal agency decisions generally establish the requirement for a formal monitoring program to evaluate the progress of revegetation and reclamation. This, along with soil erosion monitoring (through review of reclamation efforts and mass movement), is the responsibility of both agencies and companies involved with disturbance. This is to be accomplished through a joint, coordinated monitoring effort.

The following is a proposed outline of agency/company responsibility regarding implementation of the Revegetation, Reclamation and Erosion Monitoring Plan.

1. As part of the Erosion, Revegetation and Restoration Plan (ERRP), BLM and/or industry will submit an "initial" monitoring plan covering the extent of disturbance. This plan constitutes the Implementation Phase of monitoring and will follow the guidelines presented under "FORM I" of this report. Monitoring locations, timeframes and methodology will be agreed upon before acceptance of the Surface Use Plan (ERRP - pt. 10) by the agency. The monitoring will be installed by a designated "qualified" representative of the company (in coordination with the appropriate agency) immediately following initial rehabilitation work. This monitoring will be re-examined by the above representative at the end of the first growing season, with results documented in a report (see "FORM II") to the appropriate agency. Problem areas identified in this report will receive follow-up rehabilitation/erosion control measures.

2. During the second growing season, the designated agency personnel will revisit these established monitoring sites. Original methodology will be repeated and status of reclamation efforts assessed using the guidelines established in the FORM II of this report (Establishment Phase). Results will be documented in a project file (computer disk) and a report will be prepared. The monitoring results will be provided to each company or Operator, to show progress and call attention to additional stabilization/reclamation needs.

Additional monitoring sites will be established by agency personnel (in coordination with the company) for "long term" monitoring on significant problem areas not covered by initial efforts.

3. Follow-up monitoring using the established sites and methodology will be accomplished by agency personnel annually, until reclamation goals are attained (see Criteria for Success). When this occurs, the monitoring site will be abandoned, however reference points will remain to allow potential future evaluation. Abandonment is expected on most sites within approximately 3 years. This will allow personnel to concentrate on monitoring installation and evaluation on "long term" problem sites. Companies will be advised to reclamation status through joint review of monitoring sites. Annual reports will continue, as will direction for additional remedial reclamation efforts if necessary.

4. The aforementioned proposal, applies to surface disturbances occurring after the finalization of the decision document. For disturbances existing before this time, the appropriate agency is responsible for initiation and follow-up monitoring, utilizing guidelines proposed in this report.

5. The last phase involves the final review and report on status. Generally, reclamation success in the decision document will be based on specific site potential. Revegetation objectives and success criteria (FORM I) will be tailored to site potential and agreed upon by both company and agencies. When the site has reached long term stabilization and the composition of desired forage is consistent with the above objectives and criteria, the monitoring site will be abandoned. At this point, data will be compiled (by the agency involved) in an effort to provide future direction for successful reclamation. Suggested successful reclamation methods will be provided in the annual report.

Monitoring Guidelines

The following form records are proposed as guidelines for covering the collection of site specific information, identification of revegetation objectives, documentation of treatments and a record for evaluation.

FORM I (*Reclamation and Erosion Monitoring; Background Data*) is the initial step in the monitoring process. The monitoring plan contained in the ERRP should cover the parameters outlined on this form, and the representative who will collect this data. It is suggested this background be collected immediately following initial reclamation work. A report containing this information will be prepared, prior to the annual review. Data collection (except for reference plot) will be accomplished by use of point sampling transects conducted within the right-of-way boundaries. These transects will be established with permanent stakes on the locations described in the ERRP.

FORM II (*Revegetation Evaluation*) is considered the annual monitoring, to be conducted by the company (for the first growing season) and agencies (annually until monitoring abandonment). It is suggested to take place during the seed ripe stage of plant development. A evaluation report containing this information will be prepared prior to the annual review.

FORM I
Revegetation and Erosion Monitoring: Background Data

A. Revegetation Project Name: _____
Company: _____ Telephone No: (___) _____
Data collected by: _____ (Company/Agency Representative)
Monitoring Site Number: _____

B. Legal Location
Twp. _____
Rng. _____
Sec. _____
Sub. _____

C. Slope %_____
Aspect _____
Elevation _____
(include construction map with transect site marked)

D. Key Species in Reference Vegetation
_____ - _____ %
_____ - _____ %
_____ - _____ %
_____ - _____ %
_____ - _____ %
_____ - _____ %

E. Soil:

	Texture	- Rock Content		Texture	- Rock Content
0-6"	_____	- _____ %	12-18"	_____	- _____ %
6-12"	_____	- _____ %	18-24"	_____	- _____ %

F. Disturbance Description: Date_____
_____

G. Revegetation Objective(s): _____
_____
_____

H. Criteria for Determining Success: _____
_____
_____

I. Reclamation Treatment Record - Date/season applied: _____

1. Topsoiling: _____
_____
2. Erosion Control (type and method of installation): _____
_____
3. Soil Amendments (type, amount, and method of application): _____
_____
4. Seed Mix (lbs pure live seed/acre by species): _____
_____
_____
5. Mulch (type and method of application): _____
_____
_____
6. Mechanical treatments (type and rationale): _____
_____
_____
7. Remarks: _____
_____

J. Attach a 35 mm photograph of the monitoring transect and reference plot (if applicable) with dates. Photograph sites should be clearly marked on a reference map.

FORM II

Revegetation and Erosion Monitoring Evaluation

A. Revegetation Project Name: _____
Company: _____ Telephone No: ( )_____
Data collected by: _____ (Company/Agency Representative)

Monitoring Site Number: _____

B. Revegetation Evaluation:

1. Percent Cover	2. Dominant Species	Relative - Percent
_____ % Plant	_____	- _____
_____ % Litter	_____	- _____
_____ % Rock	_____	- _____
_____ % Bare Ground	_____	- _____
_____ % Water	_____	- _____
100 % Total	_____	- _____
	_____	- _____
	_____	- _____
	_____	- _____
	_____	- _____

3. Seedling Density & Abundance
_____: Average plants per linear ft. (drill row/transect)
_____: Rating

4. Grazing Impact (Utilization)
_____: Utilization
_____: Rating

EROSION EVALUATION: Evaluate conditions 50 feet on either side of transect line. Assign a numerical rating for each category.

SURFACE LITTER	No movement, or if present, less than 2 percent of the litter has been translocated and redeposited against obstacles. 0 or 3	Between 2 and 10 percent of the litter has been translocated and redeposited against obstacles. 6	Between 10 and 25 percent of the litter has been translocated and redeposited against obstacles. 8	Between 25 and 50 percent of the litter has been translocated and redeposited against obstacles. 11	More than 50 percent of the litter has been translocated and redeposited against obstacles. 14
SURFACE ROCK MOVEMENT	No movement, or if present, less than 2 percent of the surface rock fragments have been translocated and/or redeposited against obstacles and show an even distribution on the landscape. 0 or 2	Between 2 and 10 percent of the surface rock fragments have been translocated/redeposited against obstacles and begun to show localized concentration. 5	Between 10 and 25 percent of the surface rock fragments have been translocated, redeposited against obstacles, and show localized concentration. 8	Between 25 and 50 percent of the surface rock fragments have been translocated, redeposited against obstacles, and show localized concentration. 11	More than 50 percent of the surface rock fragments have been translocated, deposited against obstacles, and show extreme localized concentration. 14
PEDESTALLING	Pedestals are mostly less than 0.1 in. (2.5 mm) high and/or less frequent that 2 pedestals per 100 ft². 0 or 3	Pedestals are mostly between 0.1 to 0.3 in. (2.5 to 8 mm) high and/or have a frequency of 2 to 5 pedestals per 100 ft². 6	Pedestals are mostly between 0.3 and 0.6 in. (8 to 15 mm) high and/or have a frequency of 5 to 7 pedestals per 100 yd². 9	Pedestals are mostly between 0.6 to 1 in. (15 to 25 mm) high and/or have a frequency of 1 to 10 pedestals per 100 ft². 12	Pedestals are mostly over 1 in. (25 mm) high and/or have a frequency of over 10 pedestals per 100 ft². 14
FLOW PATTERNS	None, or if present, less than 2 percent of the surface area shows evidence of recent translocation and deposition of soil and litter. 0 or 3	Between 2 and 10 percent of the surface area shows evidence of recent translocation and deposition of soil and litter. 6	Between 10 and 25 percent of the surface area shows evidence of recent translocation and deposition of soil and litter. 9	Between 25 and 50 percent of the surface area shows evidence of recent translocation and deposition of soil and litter. 12	Over 50 percent of the surface area shows evidence of recent translocation and deposition of soil and litter. 15
RILLS	Rills, if present, are mostly less than 0.5 in. (13 m) deep, and generally at infrequent intervals over 10 ft. 0 or 3	Rills are mostly 0.5 to 1 in. (13 to 25 mm) deep and generally at infrequent intervals over 10 ft. 6	Rills are mostly 1 to 1.5 in. (25 to 38 mm) deep and generally at 10-ft. intervals. 9	Rills are mostly 1.5 to 3 in. (38 to 76 mm) deep and at intervals of 5 to 10 ft. 12	Rills are mostly 3 to 6 inches (76 to 152) deep and at intervals of less than 5 ft. 14
GULLIES	No gullies, or if present, less than 2 percent of the channel bed and walls show active erosion (are not vegetated), gullies make up less than 2 percent of the total area. 0 or 3	Between 2 and 5 percent of the channel bed and walls show active erosion (are not vegetated), or gullies make up between 2 and 5 percent of the total area. 6	Between 5 and 10 percent of the channel bed and walls shows active erosion (are not vegetated), or gullies make up between 5 and 10 percent of the total area. 9	Between 10 to 50 percent of the channel bed and walls show active erosion (are not vegetated), or gullies make up between 10 to 50 percent of the total area. 12	Over 50 percent of the channel bed and walls show active erosion (are not vegetated) along their length, or gullies make up over 50 percent of the total area. 15
SOIL MOVEMENT	Depth of recent deposits around obstacles or in microterraces, and/or depth of truncated areas, is between 0 and 0.1 in. (0 to 2.5 mm). 0 or 3	Depth of recent deposits around obstacles or in microterraces, and/or depth of truncated areas, is between 0.1 and 0.2 in. (2.5 to 5 mm). 5	Depth of recent deposits around obstacles or in microterraces, and/or depth of truncated areas, is between 0.2 and 0.4 in. (5 to 10 mm). 8	Depth of recent deposits around obstacles or in microterraces, and/or depth of truncated areas, is between 0.4 and 0.8 in (10 to 20 cm). 11	Depth of recent deposits around obstacles or in microterraces, and/or depth of truncated areas, is over 0.8 in. (20 cm). 14

Erosion Condition Class: _____ Soil Surface Factor: _____

Methodology

Most items listed in the guidelines of FORM I and FORM II are self-explanatory. Those that require a detailed explanation of methods and ratings are listed herein.

FORM I

B. A 1:24,000 topographic map can be used to attain this information. This report should include the monitoring site transect location on the detailed construction drawings contained in the ERRP.

D. Reference vegetation serves as a standard of comparison to assess potential species for revegetation and success. The nature of comparisons with reference vegetation will depend on revegetation objectives. A reference plot location will be established on-the-ground and marked on the ERRP map. A 35 mm photo of the plot will accompany the report.

G. Soil stability, productivity restoration, and wildlife habitat enhancement are general examples of objectives.

H. Examples of Criteria for Success could include 60 percent groundcover for erosion control, soil surface factor of less than 45, specific diversity requirements for wildlife habitat, and specific production for livestock grazing. Criteria must be defined and measurable.

I. The reclamation treatment record should document what was actually done on-the-ground not necessarily what is outlined in ERRP. Short explanations on which topsoiling was completed, the erosion control methods used, fertilizes type and rate, seed mix by lbs/species, mulching methods, etc. should be described in this section. Any additional erosion control measures, should be included under remarks.

J. A photo record (35mm - 50mm lens) of the transect line from point A to point B, and any additional erosion control measures, should be included in the report. Each transect should have one photo showing the general view along the transect and one photo showing transect detail of the vegetation/soil surface. Photos should be properly labeled for date, transect, and direction of view.

FORM II

B.1. Percent cover is determined by examination of 100 points along a 100 foot transect. Documentation consists of recording the total number of "hits" for plant, litter, rock and bare ground. Each point noted, corresponds to every foot increment on the 100 foot tape. Data summarized from this transect is recorded here.

B.2. Dominant vegetative species along the transect are listed and their relative percent composition determined based on the number of "hits" for each species.

B.3. Seedling Density and Relative Abundance. Total number of plants is rated by selection of plots at the 20-, 40-, 60-, and 80-foot mark on the transect. At these points, perennial seedlings per linear foot or drill row (or in the case of broadcast seedling, per linear foot of transect) are recorded and averaged. Ratings are based on the evaluation system in the following table:

PLANTS/LINEAR FOOT	RATING
8+	Excellent
5-7	Good
3-4	Fair
0-2	Poor

B.4. The grazing impact is assessed as an ocular estimate of the percent utilization along the cover transect (at 10-foot intervals). Utilization of revegetation efforts is based on the removal of "seeded" grasses (current year's growth) by grazing. The amount of utilization is expressed in percent of above ground biomass which is grazed. The following table describes the ratings for various utilization ranges:

PERCENT UTILIZATION RANGE	RATING	GENERAL DESCRIPTION
1-40	Light	The revegetation may be topped, skimmed or grazed in patches, 60 to 80 percent of the number of current seed stalks remain intact. Most young plants are undamaged. Little or no use of non-palatable species.
44-60	Moderate	The revegetation appears entirely covered (grazed) as uniformly as natural features and facilities will allow. 15 to 25 percent of the number of current seed stalks remain intact. No more than 10 percent of the non-palatable species are utilized.
61-100	Heavy	The revegetation has the appearance of complete and repeated grazing use. Less than 10 percent of the current seed stalks are remaining. The remaining stubble of preferred grasses may be grazed to the soil surface.

C. The Erosion Condition Class/Soil Surface Factor method numerically rates soil movement, surface litter, surface rock, pedestalling, flow patterns and rill-gully formation and translates these physical factors into an evaluation of the vegetation and erosion stability of an area. Results are an expression of current erosion activity, and can be used to reflect revegetation success as a function of site stability.

Identify the numerical factor that most nearly describes the current erosion condition by circling the factors. Evaluate each erosional feature if water erosion is the **most prevalent** type of erosion. (Omit surface rock if not present.) If wind erosion is mostly prevalent, do not include the rill and gully features in the computation. The following table identifies the Erosion Condition Class based on the Soil Surface Factor:

EROSION CONDITION CLASS	SOIL SURFACE FACTOR (Range)
Stable	1-20
Slight	21-40
Moderate	41-60
Critical	61-80
Severe	81-100